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L8: Entry 4 of 57 File: USPT Apr 23, 2002

DOCUMENT-IDENTIFIER: US 6376994 B1
TITLE: Organic EL device driving apparatus having temperature compensating function

Brief Summary Text (2):
The present invention relates to an apparatus for driving a light emitting device and, more particularly, to a driving apparatus for an EL device.

Brief Summary Text (4):
Attention is paid to an EL (electroluminescence) display as a display apparatus which can be substituted for a liquid crystal display and in which a low electric power consumption, a high display quality, and a thin size can be realized. The EL display has an organic compound in which excellent light emitting performance can be expected and is used as a light emitting layer of an EL device that is used in the EL display. The device has a high efficiency and a long service life which can endure a practical use.

Brief Summary Text (7):
As will be understood from FIG. 1, the EL device can be expressed by a configuration comprising a capacitive component C and a component E having diode characteristics connected in parallel with the capacitive component. Generally, the EL device is a capacitive light emitting device.

Brief Summary Text (8):
When a light emission driving voltage is applied to the EL device, charges corresponding to a capacitance first flow to an electrode as a displacement current and are accumulated. When the voltage exceeds a certain voltage (light emission threshold voltage) that is peculiar to the device, a forward current starts to flow from an anode into an organic layer serving as a light emitting layer and light emission occurs at an intensity that is proportional to the driving current.

Brief Summary Text (9):
FIGS. 2 to 4 show light emitting characteristics (L-I, I-V, and L-V characteristics: where "L", "I", and "V" denotes a light emission luminance, a driving current, and a driving voltage, respectively) of the EL device. When the driving voltage exceeding the light emission threshold value is applied to the EL device, light emission occurs at a luminance that is proportional to the driving current in accordance with the driving voltage. When the applied driving voltage is equal to or lower than the light emission threshold value, no driving current flows and the light emission luminance is also almost equal to zero.

Brief Summary Text (23):
In case of FIG. 5, therefore, only the EL devices E.sub.1,1 and E.sub.2,1 are biased in the forward direction, the driving currents flow from the current sources 2.sub.1 and 2.sub.2 as shown by arrows, and only the EL devices E.sub.1,1 and E.sub.2,1 emit the light. In FIG. 5, each of the EL devices shown by hatched regions in the capacitors is charged to a polarity as shown in the diagram. The following reset control is performed just before the scan is shifted from the light emitting state shown in FIG. 5 to a state where the light emission of the EL devices E.sub.2,2 and E.sub.3,2 as shown in FIG. 8 is performed.

Brief Summary Text (37):
The longer the period of time during which the driving pulse is at the high level, the longer the light emitting time of the EL device and light emission luminance can be

increased. A bright state can be formed by increasing the width of the driving pulse, therefore, and a dark state can be formed by decreasing the driving pulse width, so that a multi-stage gradation control can be accomplished. The gradation control is executed on the basis of a PWM (pulse width modulation).

Detailed Description Text (9):
As shown in FIG. 12, a reverse bias voltage V.sub.B ' to be supplied to one cathode line (first electrode line or row scanning line) is not directly generated from the power voltage V.sub.B but is generated by a reverse bias generating circuit 100 having a feature of the EL device driving apparatus according to the embodiment.

Detailed Description Text (10):
The reverse bias generating circuit 100 is constructed by a resistor 101 in which one end is connected to a power source for generating the voltage V.sub.B, a resistor 102 in which one end is connected to the other end of the resistor 101, a thermistor 103 in which one end is connected to the other end of the resistor 102 and the other end is connected to the ground, and an operational amplifier 104 in which a non-inverting input terminal is connected to a common connecting point of the resistors 101 and 102 and an output terminal is connected to an inverting input terminal is connected. The thermistor 103 senses the temperature. The resistors 101, 102 and the operational amplifier 104 serve as means for compensating the temperature fluctuation.

Detailed Description Text (11):
The operational amplifier 104 generates the reverse bias voltage V.sub.B ' as an output of the reverse bias generating circuit 100 to supply the voltage V.sub.B ' to the corresponding input terminals of the scan switches 5.sub.1, 5.sub.2, . . . , and 5.sub.m. The scan switch selectively supplies the reverse bias voltage V.sub.B ' or the ground potential to a corresponding one of the cathode lines B.sub.1, B.sub.2, . . . , and B.sub.m.

Detailed Description Text (16):
A configuration of FIG. 12 can be modified to a configuration as shown in FIG. 14. In FIG. 14, a PNP transistor 105 is used in place of the operational amplifier 104 to realize a reverse bias generating circuit 100'. A current is supplied to a collector of the transistor 105 and its emitter is connected to the ground through a resistor 106. The temperature compensated reverse bias voltage V.sub.B ' is obtained from the emitter of the transistor 105 in a manner similar to the aforementioned embodiment.

CLAIMS:

16. A display apparatus, comprising:

a plurality of light-emitting devices respectively connected between a plurality of first electrode lines and a plurality of second electrode lines;

a driving circuit which selectively connects said first electrodes to connect a driving current;

a temperature detecting device which detects a temperature; and

a temperature compensating unit which compensates said driving current to increase as said temperature decreases and to decrease as said temperature increases;

wherein said display includes a driving unit having a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with

said operation temperature.

20. A display apparatus, comprising:

a plurality of light-emitting devices respectively connected between a plurality of first electrode lines and a plurality of second electrode lines;

a driving circuit which selectively connects said first electrodes to connect a driving current;

a temperature detecting device which detects a temperature; and

a temperature compensating unit which compensates a period of applying said driving current based on said temperature,

wherein said temperature compensating unit decreases said period as said temperature increases and increases said period as said temperature decreases.

24. A display apparatus, comprising:

a plurality of light-emitting devices respectively connected between a plurality of first electrode lines and a plurality of second electrode lines;

a scanning circuit which selectively connects said second electrodes to connect selectively a first potential and a second potential;

a temperature detecting device which detects a temperature;

a temperature compensating unit which compensates said first potential based on said temperature;

wherein said display includes a driving unit having: a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with said operation temperature.

32. A method for driving a display in which light-emitting devices are selectively connected to first electrodes and second electrodes, comprising;

(a) detecting a temperature;

(b) compensating a driving current, which is to be supplied to said first electrodes, to increase as said temperature decreases and to decrease as said temperature increases;

(c) supplying said driving current to said first electrodes;

wherein said display comprises a driving unit having: a plurality of first electrode lines; a plurality of second electrode lines which intersect said first electrode lines; and a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode

line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with said operation temperature.

33. A method for driving a display in which light-emitting devices are selectively connected to first electrodes and second electrodes, comprising:

(a) detecting a temperature;

(b) compensating a period for applying a driving current which is to be supplied to said first electrodes, based on said temperature; and

(c) supplying said driving current to said first electrodes during said period,

wherein said operation (b) comprises:

(b1) decreasing said period as said temperature increases, and

(b2) increasing said period as said temperature decreases.

34. A method for driving a display in which light-emitting devices are selectively connected to first electrodes and second electrodes, comprising;

(a) detecting a temperature;

(b) compensating a first potential, which is to be applied to said second electrodes, based on said temperature; and

(c) applying said first potential to said second electrodes during said period;

wherein said display comprises a driving unit having: a plurality of first electrode lines; a plurality of second electrode lines which intersect said first electrode lines; and a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with said operation temperature.

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CLAIMS:

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a plurality of light-emitting devices respectively connected between a plurality of first electrode lines and a plurality of second electrode lines;

a driving circuit which selectively connects said first electrodes to connect a driving current;

a temperature detecting device which detects a temperature; and

a temperature compensating unit which compensates said driving current to increase as said temperature decreases and to decrease as said temperature increases;

wherein said display includes a driving unit having a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with

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20. A display apparatus, comprising:

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a temperature compensating unit which compensates a period of applying said driving current based on said temperature,

wherein said temperature compensating unit decreases said period as said temperature increases and increases said period as said temperature decreases.

24. A display apparatus, comprising:

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a scanning circuit which selectively connects said second electrodes to connect selectively a first potential and a second potential;

a temperature detecting device which detects a temperature;

a temperature compensating unit which compensates said first potential based on said temperature;

wherein said display includes a driving unit having: a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with said operation temperature.

32. A method for driving a display in which light-emitting devices are selectively connected to first electrodes and second electrodes, comprising;

(a) detecting a temperature;

(b) compensating a driving current, which is to be supplied to said first electrodes, to increase as said temperature decreases and to decrease as said temperature increases;

(c) supplying said driving current to said first electrodes;

wherein said display comprises a driving unit having: a plurality of first electrode lines; a plurality of second electrode lines which intersect said first electrode lines; and a light emission control unit for selecting any of said first electrode lines every horizontal scanning period of an image signal that is supplied, selecting any of said second electrode lines in correspondence to a pixel position in said horizontal scanning period, applying a reverse bias voltage to portions between non-selected lines among said first electrode lines and non-selected lines among said second electrode lines, and supplying a driving current to portions between the selected electrode line among said first electrode lines and the selected electrode

line among said second electrode lines, wherein said EL devices are arranged in a matrix form in which one of each of electrodes and another electrode are connected to one of said first electrode lines and one of said second electrode lines, respectively, and said temperature compensating unit changes a magnitude of said reverse bias voltage in accordance with said operation temperature.

33. A method for driving a display in which light-emitting devices are selectively connected to first electrodes and second electrodes, comprising:

(a) detecting a temperature;

(b) compensating a period for applying a driving current which is to be supplied to said first electrodes, based on said temperature; and

(c) supplying said driving current to said first electrodes during said period,

wherein said operation (b) comprises:

(b1) decreasing said period as said temperature increases, and

(b2) increasing said period as said temperature decreases.

34. A method for driving a display in which light-emitting devices are selectively connected to first electrodes and second electrodes, comprising;

(a) detecting a temperature;

(b) compensating a first potential, which is to be applied to said second electrodes, based on said temperature; and

(c) applying said first potential to said second electrodes during said period;

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